

What is claimed

1. A continuous digester system comprising:

a. a pressure vessel having a
lengthwise axis, a rear upstream
inlet end having a wood chip intake
means, and a front outlet end having
a pulp outlet means, said vessel
having an elongate processing
chamber through which wood chips
travel forwardly in the presence of
a digesting agent while being
transformed into pulp, with the pulp
being discharged from the pulp
outlet means at the front outlet end
of the vessel;

b. liquid flow means to circulate
processing liquid through said
digester to carry dissolved solids
with said processing liquid, said
flow means comprising;

i. initial inlet means to
initially introduce
processing liquid into the
pressure vessel at an initial
inlet downstream location;

ii. a plurality of processing
liquid inlet means at inlet
locations along the
lengthwise axis of the
pressure vessel to introduce
processing liquid into the
processing chamber;

- iii. a plurality of processing
liquid outlet means at outlet
locations along the
lengthwise axis of the
pressure vessel to extract
processing liquid from said
processing chamber, said
outlet locations being spaced
laterally from said inlet
locations, so that flow of
said processing liquid from
each of said inlet means to
related outlet means has a
lateral flow component
through said processing
chamber;
- iv. recirculating means comprising
a plurality of
interconnecting line means,
at least some of said
interconnecting line means
connecting at least some of
the outlet means with related
inlet means at further
upstream locations to direct
processing liquid from said
at least some of said liquid
outlet means through related
interconnecting line means to
further upstream locations to
flow through the related
liquid inlet means into the
processing chamber and

laterally in the processing
chamber to other outlet means
to again be recirculated
through related
interconnecting line means to
other inlet means;

v. liquor outlet means to
discharge liquor, said liquor
outlet means being upstream
of the initial downstream
location and upstream of at
least some of said liquid
inlet means and said liquid
outlet means;

c. said digester system being
characterized in that the processing
liquid moving in a recirculating
pattern through the processing
chamber and through said
recirculating means carries dry
solid content extracted from the
wood chips during processing in the
processing chamber in a net upstream
flow pattern to be discharged from
the processing chamber at said
liquor outlet means.

2. The system as recited in claim 1, wherein
there is a washer to receive pulp from the
digester and to dewater and wash the pulp, a
substantial portion of filtrate from the washer
being directed into the initial inlet means as
said processing liquid to move through said

recirculating means in said net upstream direction.

3. The system as recited in claim 2, wherein a digesting agent is introduced into said liquid
5 flow means to flow through said recirculating means and through said processing in a net upstream direction to extract dry solids content from said wood chips being processed and carry said dry solids content in a net upstream
10 direction.

4. The system as recited in claim 3, said system further comprising an evaporation and recovery means to receive liquor discharged from said pressure vessel at a plurality of discharge
15 locations at different operating locations in said pressure vessel so as to extract liquor having different characteristics from different extraction locations.

5. The system as recited in claim 4, wherein
20 said digesting agent is alcohol, with said evaporation and recovery means extracting said alcohol from said black liquor and recirculating said recovery alcohol back to said liquid flow means to be recirculated into said liquid flow
25 means.

6. The system as recited in claim 1, wherein said system comprises an impregnation zone located in said pressure vessel at an upstream location, at least one cooking zone located downstream of said impregnation zone, and at least one wash
30 displacement zone located downstream of said cooking zone, at least some of said liquid inlet means and said liquid outlet means being located

at said displacement wash zone to receive said processing liquid and recirculate said processing liquid sequentially through related pairs of said liquid inlet means and said liquid outlet means, said flow means further comprising means to move the processing liquid from the wash displacement zone to an upstream location to be directed into said cooking zone, to flow in a downstream direction in the processing chamber toward said displacement wash zone.

7. The system as recited in claim 6, wherein at least some processing liquid from said displacement wash zone is recirculated ultimately to said impregnation zone to flow downstream in said vessel through said impregnation zone and into said cooking zone.

8. The system as recited in claim 7, wherein liquor is extracted from the impregnation zone and directed to said evaporation and recovery means for processing.

9. The system as recited in claim 8, wherein liquor is extracted from said cooking zone and directed to said evaporation and recovery means for processing.

10. The system as recited in claim 1, wherein said liquid flow means comprises at least one displacement wash zone, having a downstream end and an upstream end, with a plurality of said liquid inlet means being positioned at longitudinally spaced inlet locations along a length of said displacement wash zone and a plurality of said liquid outlet means positioned at spaced locations along a length of said

displacement wash zone, said pluralities of liquid outlet and liquid inlet means being arranged so that there are a related first downstream and a second upstream liquid inlet means being arranged to a related first downstream and second upstream outlet means in a manner that at least a portion of processing liquid from said first downstream inlet means flows through said processing chamber to pass into said first downstream outlet means, with at least a portion of flow into said first downstream inlet means being recirculating through said recirculating means to said second upstream inlet means, with at least a portion of the flow from said second liquid inlet means flowing across said processing chamber to said second upstream inlet means, with at least a portion of the flow from said second upstream inlet means being recirculated by said recirculating means in an upstream direction, thus accomplishing said net upstream flow of processing liquid.

11. The system as recited in claim 1, wherein said pressure vessel has a generally cylindrical cross sectional configuration transverse to its lengthwise axis, and said digester system comprises an inner-containing means positioned within said pressure vessel, with said inner-containing means defining the elongate processing chamber, said inner-container means comprises at least in part planar wall surfaces.

12. The system as recited in claim 11, wherein there are inlet screen means and outlet screen means located at longitudinally spaced locations at said planar wall surfaces, at least

some of said liquid inlet means passing liquid into said processing chambers through related screen means, and at least some of said liquid outlet means discharging processing liquid through
5 related screen means, at least some of said screen means having propeller blade means which move across related screen means to prevent obstruction of flow through said screen means.

13. The system as recited in claim 1,
10 wherein said pressure vessel comprises a generally cylindrical sidewall, which defines the processing chamber as a generally cylindrical processing chamber, at least one of said liquid inlet means and liquid outlet means comprises liquid
15 passageway means formed in said cylindrical sidewall, said liquid passageway means having flow axes, said flow axes being slanted in a radially inward and forward direction.

14. The system as recited in claim 13,
20 wherein said liquid flow means comprises a plurality of circumferential ring assemblies positioned at longitudinally spaced locations along said sidewall, each of said ring assemblies defining a flow chamber to communicate with
25 related passageway means extending through said wall member.

15. The system as recited in claim 1,
wherein said plurality of liquid inlet means and said plurality of liquid outlet means are arranged
30 in alignment pairs, having an alignment flow path between the liquid inlet means and the liquid outlet means of a related pair, at least some of said pairs of liquid inlet and liquid outlet means

being arranged in an alternating pattern, whereby cross flow of processing liquid between adjacent alternating pairs have different flow directions through said processing chamber.

5 16. The system as recited in claim 1,
wherein said elongate processing chamber is
defined by a longitudinally extending chamber wall
means, said liquid inlet means and said liquid
outlet means being positioned at said chamber wall
10 means in a manner that said liquid inlet means
causes processing liquid to flow through said
chamber wall means into said processing chamber,
and said liquid outlet means extracts processing
liquid from said processing chamber through said
15 chamber wall means, said liquid inlet means and
said liquid outlet means being arranged in related
alignment pairs where at least some of the liquid
from the liquid inlet means flows in a flow path
substantially across said processing chamber to
20 its related liquid outlet means.

 17. The method as recited in claim 1,
wherein there is an evaporation and recovery means
to receive liquor discharged from said pressure
vessel, said evaporation and recovery means
25 comprising at least first and second heat exchange
means to cause evaporation of liquid from said
liquor, and first and second separator means, said
first evaporator means being arranged to initially
receive liquor from said pressure vessel and to
30 discharge liquor from said first heat exchange
means, means to direct liquor from said first heat
exchange means to said first separator means said
first separator means to separate a portion of the

liquor from to the first evaporator means, means
to direct remaining liquor from said first
separator means to said second heat exchange means
where said remaining liquor is subjected to a
5 further heat exchange process, means to direct
liquor from said second evaporator means to said
second separator means to extract a portion of the
liquor from said second heat exchanger means.

18. The system as recited in claim 1,
10 wherein there are:

- a. at least one impregnation zone at an
upstream location in said pressure
vessel;
- 15 b. first and second cooking zones, with
said first cooking zone being
positioned downstream of said
impregnation zone, and said second
cooking zone being located
20 downstream of said first cooking
zone;
- c. first and second displacement wash
zones, with said first displacement
wash zone being positioned
25 downstream of said second cooking
zone, and said second displacement
wash zone being positioned between
said first and second cooking zones;
- 30 d. each of said displacement wash zones
having a downstream end and an
upstream end, with a plurality of
said liquid inlet means being
positioned at longitudinally spaced
inlet locations along a length of

5 said displacement wash zone and a
plurality of said liquid outlet
means positioned at spaced locations
along a length of said displacement
wash zone, said pluralities of
liquid outlet and liquid inlet means
being arranged so that there are a
related first downstream and a
second upstream liquid inlet means
10 being arranged to a related first
downstream and second upstream
outlet means in a manner that at
least a portion of processing liquid
from said first downstream inlet
15 means flows through said processing
chamber to pass into said first
downstream outlet means, with at
least a portion of flow into said
first downstream inlet means being
20 recirculated through said
recirculating means to said second
upstream inlet means, with at least
a portion of the flow from said
second liquid inlet means flowing
25 across said processing chamber to
said second upstream inlet means,
with at least a portion of the flow
from said second upstream inlet
means being recirculated by said
30 recirculating means in an upstream
direction, thus accomplishing net
upstream flow of processing liquid
in said displacement wash zone;

e. said recirculating means
interconnecting said first and
second wash zones with said first
and second cooking zones and said
5 impregnation zone in a manner that
within said processing chamber,
there is a substantially continuous
flow of pulp and processing liquid
in a downstream direction from the
10 inlet end to the outlet end, and a
substantially continuous flow of
processing liquid from said
displacement wash zones through said
recirculating means to upstream
15 locations into said first and second
cooking zones and into said
impregnation zone,

whereby dissolved solids are carried through said
recirculating means in a net upstream direction,
20 while wood chips being processed into pulp and the
processing liquid in the digester travel in
downstream direction.

19. The system as recited in claim 1,
wherein said pressure vessel is aligned so that
25 its major alignment component is horizontal.

20. A method of digesting wood chips, said
method comprising:

a. providing a pressure vessel having a
lengthwise axis, a rear upstream
30 inlet end having a wood chip intake
means, and a front outlet end having
a pulp outlet means, said vessel

having an elongate processing chamber;

b. feeding wood chips through said wood chip intake means into said processing chamber and causing said wood chips to travel forwardly in said processing chamber in the presence of a digesting agent while being transformed into pulp, and discharging the pulp from the pulp outlet means at the front outlet end of the vessel;

c. circulating processing liquid through said digester to carry dissolved solids with said processing liquid by:

i. initially introducing processing liquid into the pressure vessel at an initial inlet downstream location;

ii. directing processing liquid through a plurality of processing liquid inlet means at inlet locations along the lengthwise axis of the pressure vessel into the processing chamber;

iii. directing processing liquid from said processing chamber through a plurality of processing liquid outlet means at outlet locations along the lengthwise axis of

the pressure vessel to
extract processing liquid
from said processing chamber,
with said outlet locations
being spaced laterally from
said inlet locations, so that
flow of said processing
liquid from each of said
inlet means to related outlet
means has a lateral flow
component through said
processing chamber;

- iv. recirculating said processing
liquid through a plurality of
interconnecting line means,
with at least some of said
interconnecting line means
connecting at least some of
the outlet means with related
inlet means at further
upstream locations, by
directing processing liquid
from said at least some of
said liquid outlet means
through related
interconnecting line means to
further upstream locations to
flow through the related
liquid inlet means into the
processing chamber and
laterally in the processing
chamber to other outlet means
to again be recirculated

through related
interconnecting line means to
other inlet means;

5 v. discharging liquor through
liquor outlet means at at
least one location upstream
of the initial downstream
location and upstream of at
10 least some of said liquid
inlet means and said liquid
outlet means;

15 d. said method being characterized in
that the processing liquid moving in
a recirculating pattern through the
processing chamber and through said
recirculating means carries dry
solid content extracted from the
wood chips during processing in the
processing chamber in a net upstream
20 flow pattern to be discharged from
the processing chamber at said
liquor outlet means.